Published in final edited form as:

J Opioid Manag. 2017 ; 13(1): 51–57. doi:10.5055/jom.2017.0367.

An analysis of errors, discrepancies, and variation in opioid prescriptions for adult outpatients at a teaching hospital

Mark C. Bicket, MD[1], **Deepa Kattail, MD**[1], **Myron Yaster, MD**[2], **Christopher L. Wu, MD**[3], and **Peter Pronovost, MD, PhD**[4]

[1]Assistant Professor, Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD USA

[2]Professor, Department of Anesthesiology, University of Colorado-Anschutz Medical Campus, Aurora, CO USA

[3]Professor, Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University

[4]Professor, Department of Anesthesiology and Critical Care Medicine, Department of Surgery, Department of Health Policy & Management, The Johns Hopkins Bloomberg School of Public Health, Baltimore, MD USA

Abstract

Objective—To determine opioid prescribing patterns and rate of three types of errors, discrepancies, and variation from ideal practice.

Design—Retrospective review of opioid prescriptions processed at an outpatient pharmacy

Setting—Tertiary institutional medical center

Patients—We examined 510 consecutive opioid medication prescriptions for adult patients processed at an institutional outpatient pharmacy in June 2016 for patient, provider, and prescription characteristics.

Main Outcome Measure(s)—We analyzed prescriptions for deviation from best practice guidelines, lack of two patient identifiers, and noncompliance with Drug Enforcement Agency (DEA) rules.

Results—Mean patient age (SD) was 47.5 years (17.4). The most commonly prescribed opioid was oxycodone (71%), usually not combined with acetaminophen. Practitioners prescribed tablet formulation to 92% of the sample, averaging 57 (47) pills. We identified at least one error on 42% of prescriptions. Among all prescriptions, 9% deviated from best practice guidelines, 21% failed to include two patient identifiers, and 41% were noncompliant with DEA rules. Errors occurred in 89% of handwritten prescriptions, 0% of electronic health record (EHR) computer-generated

Corresponding Author: Mark C. Bicket, Johns Hopkins University School of Medicine, 600 N. Wolfe St., Baltimore, MD 21287; 410-955-1822 (phone); 410-614-2019 (fax); bicket@jhmi.edu.

Conflict of Interest: Mark Bicket, Deepa Kattail, Christopher Wu, and Peter Pronovost declare that they have no conflict of interest related to this manuscript. Myron Yaster reports consulting fees or honoraria and fees for participation in research activities from Purdue Pharma and Endopharma (consulting and data safety monitoring board work).

prescriptions, and 12% of non-EHR computer-generated prescriptions. Inter-rater reliability by kappa was 0.993.

Conclusions—Inconsistencies in opioid prescribing remain common. Handwritten prescriptions continue to demonstrate higher associations of errors, discrepancies, and variation from ideal practice and government regulations. All computer-generated prescriptions adhered to best practice guidelines and contained two patient identifiers, and all EHR prescriptions were fully compliant with DEA rules.

Keywords

Opioid analgesics; pain medication; medication use; prescription error

Introduction

Medication prescription errors represent a serious yet often preventable source of harm within the healthcare system. Opioids in particular are a high-risk class of medications associated with the highest frequency of reported medication errors that cause patient harm [1,2]. Although errors may occur at any point in the multistep process of prescribing, transcribing, dispensing, administering, and monitoring a medication, research on errors with opioid medications has rarely focused on prescribing at the time of discharge from the hospital or on the written prescriptions provided to adults [3,4]. Nevertheless, discharge from the hospital to home or another facility is an established source of potential errors for medication prescribing. Prior studies that focused on pediatric populations uncovered high error rates on handwritten prescriptions (>80% of all prescriptions) and a striking ability to mitigate almost all errors through use of computer-generated prescriptions [5,6]. Such findings suggest that studies of errors among prescriptions for adults are also warranted.

The need to proactively address the potential for harms from prescription opioid medications in adult patients is underscored by the epidemic of prescription opioid abuse [7]. Best practices for prescriptions derive from organizations such as the Institute for Safe Medication Practices, whose list of error-prone abbreviations, symbols, and dose designations captures frequently misinterpreted characters involved in prior medication errors [8,9]. Beyond best-practice guidelines, opioid prescriptions fall under the purview of broader national patient safety goals and legal rules and regulations from the government. Government regulation of controlled substance prescribing lies within the domain of the United States Drug Enforcement Agency (DEA), whose Manual for Prescribing, last published in 2006, contains rules and regulations that govern scheduled medications including opioids [10]. Additionally, medication errors represent a key area of focus for patient safety organizations such as The Joint Commission. Based on the recommendations and regulations of these various bodies, current standards for opioid prescription writing include the use of two patient identifiers [11,12]. absence of easily misinterpreted abbreviations and symbols, and adherence to DEA rules.

The purpose of this study was to use outpatient pharmacy data to assess the practice patterns of providers who prescribe opioid medications to adults being discharged from the hospital. In addition to describing the characteristics of outpatient opioid prescriptions, objectives

included determining how many prescriptions adhere to best practice guidelines, contain at least two patient identifiers, and comply with DEA rules regarding controlled medication prescribing.

Methods

This project received classification as a quality improvement project from the Johns Hopkins Hospital institutional review board. The study was conducted at the Johns Hopkins Hospital (JHH) East Baltimore campus, which is an urban, academic, tertiary care center located in Baltimore, Maryland. We examined all opioid medication prescriptions (schedule II and III) received and processed by one outpatient pharmacy located within the JHH for 15 consecutive days in June 2016. This pharmacy location processes opioid prescriptions for patients who have undergone same-day surgery for orthopedic, thoracic, cardiac, and neurosurgical conditions. Opioid prescriptions may also include those for patients who are discharged from the hospital after surgery or medical admission and those provided after outpatient encounters.

We studied prescribers, including trainees, who wrote opioid prescriptions for patients 18 years of age and older. We examined prescriptions for demographic information (patient age), prescriber information (credentials, DEA registration number), type of opioid medication (name, formulation, combination with acetaminophen), amount of drug dispensed, and method of prescription generation (handwritten, electronic health record [EHR] computer-generated [i.e., Epic], non-EHR computer generated, etc.). One investigator examined prescriptions for errors and discrepancies according to three different standards: 1) prescription errors based on previously used “best practice” guidelines in prescription error research [6]; 2) The Joint Commission recommendation for two patient identifiers, which include name, medical record number, date of birth, phone number, address, social security number, and photograph [11,12]; and 3) the DEA Practitioner’s Manual Valid Prescription Requirements, which require a prescription to include characteristics such as the patient’s full name and address (Table 1) [10]. A second investigator independently examined a subset of handwritten prescriptions and prescriptions noted to contain at least one error for confirmation. Any discrepancies were resolved by consensus.

We collected data using a standardized, computerized form with field validation on Microsoft Access. We analyzed data using STATA (StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP) with absolute and relative frequencies of errors. Descriptive statistics included mean ± standard deviation (SD), range, and interquartile range (IQR). Credential information missing from prescriptions was obtained by searches of National Provider Identifier, hospital webpage, or other online resource. DEA number was dichotomized by practitioners who use the hospital DEA number (likely trainees) versus those who used their own DEA number. We calculated exact binomial 95% confidence intervals (CI) for individual error and discrepancy rates. Comparisons of error frequencies were calculated by using the chi-squared statistic with statistical significance set at $p < 0.05$. Reliability was calculated by the kappa statistic.

Results

We received a total of 510 opioid prescriptions. Date of birth was missing on two prescriptions, and credential information was missing on three. Prescriptions were provided to 451 patients with ages ranging from 18 to 100 years (mean ± SD, 47.5 ± 17.4 years). Physicians wrote most of the prescriptions (60%), followed by physician assistants (29%), advanced practice nurses (11%), and other providers such as dentists and podiatrists (<1%). The most commonly prescribed opioid was oxycodone immediate release (IR; 71%; Table 2). Other prescription opioids included hydromorphone IR (10%), morphine IR (3%), oxycodone continuous release (CR; 3%), fentanyl patches (3%), tramadol IR (3%), and morphine CR (2%). Opioids with acetaminophen were prescribed to less than 3% of the sample (15/510).

The most frequent formulation of opioid prescribed to adults was in tablet form (92%). The only opioids dispensed as liquid solution (4%) were morphine IR and oxycodone IR. The remaining formulations consisted of patches (3%) for transdermal fentanyl and film (<1%) for either suboxone or buprenorphine. The number of opioid tablets prescribed averaged 57 ± 45 pills (range, 4-390 pills; IQR, 5-270 pills), whereas the median was 45 pills (Figure 1). In this sample, the number of opioid tablets dispensed for the top 25% of all prescriptions (13,870) was greater than the number dispensed for the remaining 75% of opioid prescriptions (12,947). Liquid solution volume averaged 276 ± 217 mL (range 30-800 mL; IQR 60-470 mL).

The 510 opioid prescriptions consisted of similar numbers of handwritten (47%) and hospital computer-generated (47%) prescriptions, but fewer prescriptions were generated by non-hospital computer software (7%). These findings aligned well with the hospital's use of Epic as the primary electronic health record system. Additionally, a small number of patients ≥18 years old who filled prescriptions after surgery or admission at the pediatric hospital received prescriptions completed via a proprietary non-Epic prescription writer for opioid medications that was previously shown to eliminate nearly all prescription errors [6].

All prescriptions contained the patient's name; prescriber's first and last name; DEA number; and drug information, including name, dose, formulation, and quantity to dispense. Among all prescriptions, 42% contained at least one error (95% CI, 38.0%-46.8%). Approximately 9% of the prescriptions contained at least one deviation from best practice guidelines (95% CI, 6.7%-11.8%), 21% failed to include at least two patient identifiers on the written prescription (95% CI, 17.9%-25.2%), and 41% were noncompliant with the 2006 DEA rules regarding controlled prescriptions (95% CI, 37.1%-45.8%; Table 3). Seventy-two percent of the prescriptions that deviated from best practice used error-prone abbreviations or symbols. The remainder did not properly list the date, frequency, formulation, or number of pills. Failure to properly list the patient's address resulted in every instance of noncompliance with the 2006 DEA rules. All prescriptions containing a best-practice deviation or lacking two patient identifiers were written by hand and not computer-generated.

Compared with prescribers who used other DEA numbers, prescribers who used the hospital DEA number were less likely to deviate from best-practice ($p = 0.03$) or be noncompliant with DEA rules ($p = 0.03$), but they lacked two patient identifiers at a similar rate ($p = 0.87$). Physicians were less likely than advanced practice nurses or physician assistants to write prescriptions that had deviations ($p < 0.001$), lacked identifiers ($p = 0.02$), or were noncompliant ($p < 0.001$). The frequency of handwritten prescriptions did not vary by DEA classification ($p = 0.11$), but the proportion of prescriptions written by hand was higher among advanced practice nurses and physician assistants than among physicians ($p < 0.001$).

A second reviewer evaluated, in duplicate, data points extracted for each of 50 prescriptions (10% of the sample) that contained at least one error or discrepancy. We calculated an inter-rater reliability of 0.993 by the kappa statistic.

Discussion

Our study showed that pain medication prescriptions written for adults during discharge from the hospital or ambulatory center after surgery contain a significant number of errors, discrepancies, and variations. Errors were common, with 42% of prescriptions having at least one. Deviations from best practice guidelines were noted in prescriptions that used error-prone abbreviations, symbols, and dose designations. Other errors included incorrect dates, medication frequency, and number of pills, among others. Only opioid prescriptions written by hand, and not those that were computer-generated, contained best-practice deviations. Though these deviations appear at the surface to be innocuous, they increase the probability that another error or misstep may lead to actual patient harm. Twenty-one percent of prescriptions lacked two patient identifiers, and over 40% failed to meet valid prescription requirements set forth by the DEA. A missing patient address was the cause of all instances of DEA noncompliance.

Medication errors have been linked in a chain leading to potential and actual adverse drug events in adults.[Bates] However, medication error data for adults undergoing post-surgery discharge from the hospital or ambulatory center are lacking. Our findings are similar to those of Bates et al., who showed that medication errors, though common, are preventable through the use of computer-generated prescriptions [5,6,13]. The high rates of inconsistencies that we observed in opioid prescribing are plausible when considering the high rate of handwritten prescriptions in this sample. Writing prescriptions by hand affects areas beyond the pharmacy, as errors may also be introduced through inaccurate medication reconciliation at time of discharge or during a subsequent ambulatory encounter.

Historically, prescriptions written by trainees have been associated with high error rates [14]. Many of the prescriptions written for patients in our study were completed by trainees, designated in part by their use of the hospital DEA registration number. Prescriptions with the hospital DEA registration number had a lower frequency of best-practice deviations and noncompliance with DEA rules, but lacked two patient identifiers at rate similar to that of prescriptions listing another DEA number. The inadequate inclusion of patient identifiers may result from the use of hospital-supplied controlled substance prescriptions, which designate a space for patient age, but not date of birth. Unlike birth date, age does not

qualify as a patient identifier. Higher rates of compliance may stem from encouraging computer generation of prescriptions, changing the age field to date of birth, or reducing the use of preprinted controlled substance prescriptions [15].

We identified a small percentage of prescriptions for opioids with acetaminophen (<3%). Although this finding aligns with safety efforts by agencies such as the FDA to reduce the usage of combination products [16], it differs from the existing wide practice in the United States [17]. Practitioners prescribe combination products such as hydrocodone-acetaminophen more often than any other pain medication in certain populations, such as beneficiaries of the Medicare Part D Prescription Drug Program [18]. The use of acetaminophen as part of a multimodal pain treatment regimen may attenuate opioid-induced side effects, but it increases the risk of acetaminophen toxicity [19,20].

Our study has a number of policy implications. Practitioners prescribed large amounts of opioids to patients. Although not an error per se, we do not know the amount of prescribed opioid that is actually used by the patient. Unused opioid pills contribute to the supply of medication that may be diverted, ultimately augmenting America's opioid addiction epidemic [21]. This epidemic underscores the need to appropriately track opioid medication prescriptions, given that opioids prescribed after surgery or hospitalization may contribute to their non-medical use [22]. There is no routine audit of opioid-prescribing errors after surgery. With the high number of errors, policy makers should work toward implementing feasible methods to audit errors in pharmacies and feed the data back to hospitals. In addition, these audits should more closely evaluate the number of pills prescribed. Some patients were provided very high numbers of pills. Policy makers could require that prescribers develop policies for an evidenced-based approach regarding the number of pills prescribed and audit practices against those policies. Finally, greater education is needed for prescribers and patients on the value and potency of non-narcotic adjuvant therapy. For some of these prescriptions, patients could realize equal pain relief from a non-narcotic drug. Audits could also include appropriate use of adjuvants when appropriate.

We recognize this study has limitations. First, only one abstractor reviewed all records, which raises the possibility of misclassification of some events. To assess this possibility, we asked a second reviewer to independently examine a 10% sample. The high kappa value suggested that misclassification was likely low. Second, we sampled during 15 days in the month of June. Seasonal variation in error rates may have affected our results. We did not collect data on the indication for use, so we are unable to comment on whether the number of pills prescribed was appropriate. Weight information was not available for many patients in this sample and could possibly increase the number of errors found in the sample, though adults are less likely than children to require weight-based dosing of opioids. We studied patients discharged from a large academic medical center who had prescriptions filled at a pharmacy associated with a hospital. Therefore, our results may not be generalizable to non-hospital-based pharmacies. Nevertheless, these error rates were concerning and warrant additional research.

In conclusion, errors in opioid prescriptions written for adults are common and, in this sample, exclusively present in handwritten formats. A significant number of prescriptions

lacked two patient identifiers, and even more were noncompliant with DEA rules regarding valid prescription requirements. Reducing these errors, discrepancies, and variations in practice represents a worthy area of future inquiry. As the utilization of computer-based prescribing increases, practitioners must recognize the potential of such platforms to improve the safety of opioid and medication prescribing, especially during critical periods of care such as discharge after surgery or hospitalization.

Acknowledgments

None

Funding: This study did not receive funding.

References

1. Colquhoun M, Koczmara C, Greenall J. Implementing system safeguards to prevent error-induced injury with opioids (narcotics): an ISMP Canada collaborative. Healthc Q. 2006; 9(Spec):36–42. [PubMed: 17087166]
2. Hicks RW. MEDMARX 5th anniversary data report: a chartbook of 2003 findings and trends 1999–2003. Medical Benefits. 2005; 22:10–11.
3. Leape, LL. Systems analysis and redesign: the foundation of medical error prevention. In: Cohen, MR., editor. Medication errors. 2nd. Washington, DC: American Pharmaceutical Association; 2007. p. 3-14.
4. Heneka N, Shaw T, Rowett D, et al. Quantifying the burden of opioid medication errors in adult oncology and palliative care settings: A systematic review. Palliat Med. 2016; 30(6):520–532. [PubMed: 27178835]
5. Lee BH, Lehmann CU, Jackson EV, et al. Assessing controlled substance prescribing errors in a pediatric teaching hospital: an analysis of the safety of analgesic prescription practice in the transition from the hospital to home. J Pain. 2009; 10(2):160–166. [PubMed: 19010736]
6. George JA, Park PS, Hunsberger J, et al. An Analysis of 34,218 Pediatric Outpatient Controlled Substance Prescriptions. Anesth Analg. 2016; 122(3):807–813. [PubMed: 26579844]
7. Califf RM, Woodcock J, Ostroff S. A Proactive Response to Prescription Opioid Abuse. N Engl J Med. 2016; 374(15):1480–1485. [PubMed: 26845291]
8. Electronic Prescribing Can Reduce Medication Errors. Institute for Safe Medication Practices. Available at: http://www.ismp.org/Newsletters/acutecare/articles/Whitepaper.asp Accessed 2 Aug 2016
9. ISMP's List of Error-Prone Abbreviations, Symbols, and Dose Designations. Institute for Safe Medication Practices. 2014. Available at: http://www.ismp.org/Tools/errorproneabbreviations.pdf Accessed 2 Aug 2016
10. Practitioner's manual: an informational outline of the controlled substances act. United States Department of Justice Drug Enforcement Administration, Office of Diversion Control. 2006. Available at: http://www.deadiversion.usdoj.gov/pubs/manuals/pract/pract_manual012508.pdf Accessed 1 Aug 2016
11. 2016 Ambulatory Care National Patient Safety Goals. The Joint Commission. 2016. Available at: https://www.jointcommission.org/assets/1/6/2016_NPSG_AHC_ER.pdf Accessed 2 Aug 2016
12. 2016 Ambulatory Care National Patient Safety Goals. The Joint Commission. 2016. Available at: https://www.jointcommission.org/standards_information/npsgs.aspx Accessed 1 Aug 2016
13. Bates DW, Boyle DL, Vander Vliet MB, et al. Relationship between medication errors and adverse drug events. J Gen Intern Med. 1995; 10(4):199–205. [PubMed: 7790981]
14. Meyer TA. Improving the quality of the order-writing process for inpatient orders and outpatient prescriptions. Am J Health Syst Pharm. 2000; 57(Suppl 4):S18–S22.
15. Zimmer KP, Miller MR, Lee BH, et al. Narcotic prescription writer: Use in medical error reduction. J Patient Saf. 2008; 4(2):98–105.

16. Acetaminophen Prescription Combination Drug Products with more than 325 mg. FDA Statement - Recommendation to Discontinue Prescribing and Dispensing. Food and Drug Administration. 2014. Available at: http://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm381650.htm Accessed 15 Aug 2016

17. Clark R, Fisher JE, Sketris IS, Johnston GM. Population prevalence of high dose paracetamol in dispensed paracetamol/opioid prescription combinations: an observational study. BMC Clin Pharmacol. 2012; 12:11. [PubMed: 22709372]

18. CMS releases prescriber-level Medicare data for first time. Centers for Medicare & Medicaid Services. 2015. Available at: https://www.cms.gov/newsroom/MediaReleaseDatabase/Fact-Sheets/2015-Fact-sheets-items/2015-04-30.html Accessed 15 Aug 2016

19. Michna E, Duh MS, Korves C, et al. Removal of opioid/acetaminophen combination prescription pain medications: assessing the evidence for hepatotoxicity and consequences of removal of these medications. Pain Med. 2010; 11(3):369–378. [PubMed: 20447306]

20. A Guide to Safe Use of Pain Medicine. Food and Drug Administration. 2009. Available at: http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm095673.htm Accessed 20 Aug 2016

21. Dart RC, Surratt HL, Cicero TJ, et al. Trends in opioid analgesic abuse and mortality in the United States. N Engl J Med. 2015; 372(3):241–248. [PubMed: 25587948]

22. Kharasch ED, Brunt LM. Perioperative Opioids and Public Health. Anesthesiology. 2016; 124(4): 960–965. [PubMed: 26808634]

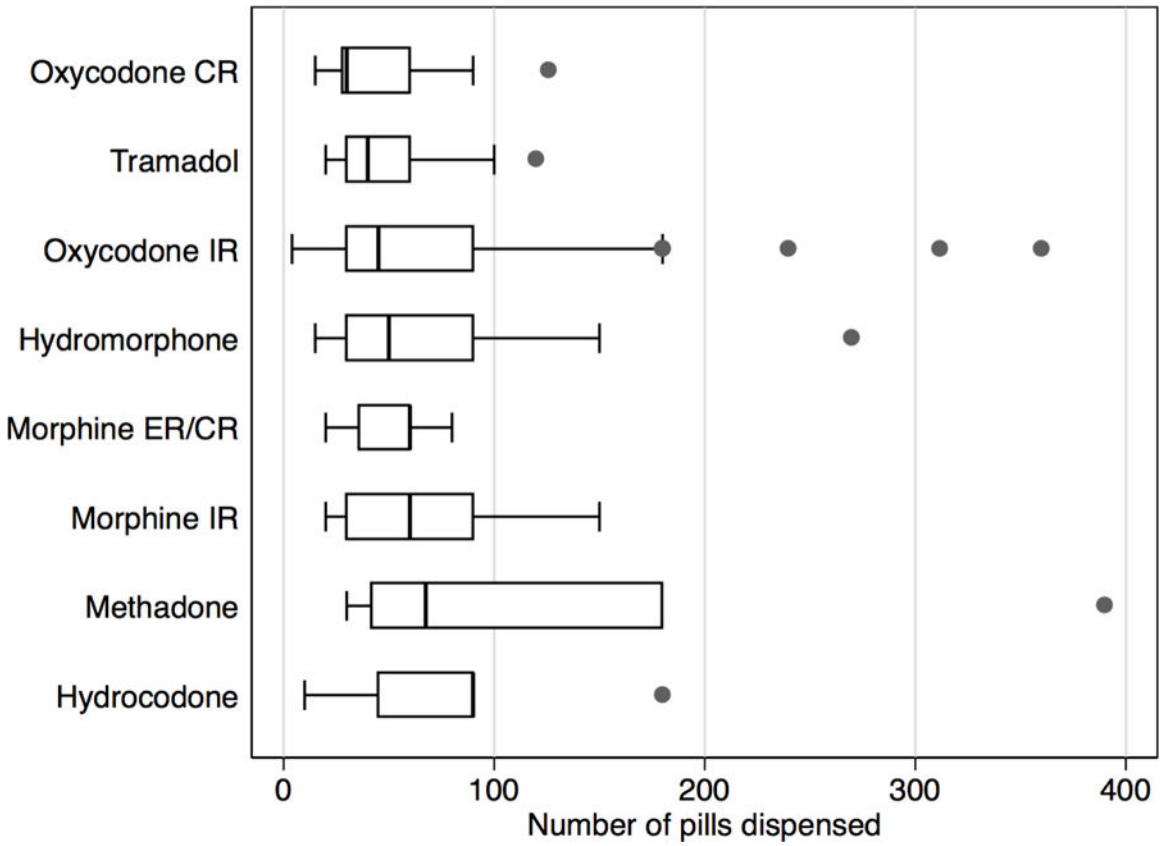

Figure 1.

Amount of opioid dispensed per prescription. Data are shown for opioids dispensed as tablets with >3 prescriptions. Black line denotes median number of pills dispensed, boxes represent interquartile range (25^{th} to 75^{th} percentile), and whiskers denote upper and lower adjacent values. CR = continuous release; ER = extended release; IR = immediate release.

Table 1

Types of prescription errors, discrepancies, and variation

“Best practice” guidelines
1. Illegible prescription
2a. Illegible signature or printed patient name
2b. Illegible signature or printed provider name
3. No date listed on prescription
4. No weight or age recorded on prescription for patients weighing <40 kg
5. Wrong formulation of medication
6. Wrong dose of medication
7. Wrong frequency of medication
8. No information on dose/kg body weight for patients weighing <40 kg
9. No pill quantity
10. Wrong instructions given (e.g., crush long-acting opioid tablet)
11. No callback telephone number
12. Use of error-prone abbreviations, symbols, or dose designations
The Joint Commission
Presence of two patient identifiers, in addition to name, such as any one of the following: address, date of birth, medical record number, photograph, or other identifier
DEA Practitioner’s Manual Valid Prescription Requirements
Patient’s full name
Patient’s address
Practitioner’s full name
Practitioner’s address
Practitioner’s DEA registration number

Table 2

Opioid prescriptions by name and formulation

Drug name	Total (n=510)	Tablet (n=468)	Solution (n=21)	Patch (n=16)	Film (n=5)
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Oxycodone IR	360 (70.6)	345 (73.7)	15 (71.4)	0 (0)	0 (0)
Hydromorphone IR	49 (9.6)	49 (10.5)	0 (0)	0 (0)	0 (0)
Morphine IR	17 (3.3)	11 (2.4)	6 (28.6)	0 (0)	0 (0)
Oxycodone CR	17 (3.3)	17 (3.6)	0 (0)	0 (0)	0 (0)
Fentanyl patch	16 (3.1)	0 (0)	0 (0)	16 (100)	0 (0)
Tramadol IR	14 (2.7)	14 (3.0)	0 (0)	0 (0)	0 (0)
Morphine ER/CR	12 (2.4)	12 (2.6)	0 (0)	0 (0)	0 (0)
Hydrocodone IR	8 (1.6)	8 (1.7)	0 (0)	0 (0)	0 (0)
Methadone	6 (1.2)	6 (1.3)	0 (0)	0 (0)	0 (0)
Suboxone	5 (1.0)	1 (0.2)	0 (0)	0 (0)	4 (80)
Oxymorphone ER	2 (0.4)	2 (0.4)	0 (0)	0 (0)	0 (0)
Buprenorphine	1 (0.2)	0 (0)	0 (0)	0 (0)	1 (20)
Codeine	1 (0.2)	1 (0.2)	0 (0)	0 (0)	0 (0)
Nyucenta	1 (0.2)	1 (0.2)	0 (0)	0 (0)	0 (0)
Tapentadol IR	1 (0.2)	1 (0.2)	0 (0)	0 (0)	0 (0)

CR = continuous release; ER = extended release; IR = immediate release.

Table 3

Prescription errors and discrepancies for opioid medications prescribed to adults

Prescriptions	All	DEA classification		Prescriber credentials[a]				Format		
		Other DEA	Hospital DEA	Physician (MD/DO)	Nurse (APN)	PA	Other	Written by hand	Comp. EHR	Comp. non-EHR
N	510	310	200	305	55	145	2	239	237	34
At least one error, n (%)	216 (42)	143 (46)	73 (37)	90 (30)	30 (55)	93 (64)	0 (0)	212 (89)	0 (0)	4 (12)
Deviation from best practice, n (%)	46 (9)	35 (11)	11 (6)	15 (5)	13 (24)	17 (12)	0 (0)	46 (19)	0 (0)	0 (0)
Lack of two patient identifiers, n (%)	109 (21)	67 (22)	42 (21)	53 (17)	13 (24)	42 (29)	0 (0)	109 (46)	0 (0)	0 (0)
Noncompliant with 2006 DEA rules, n (%)	211 (41)	140 (45)	71 (36)	88 (29)	29 (53)	91 (63)	0 (0)	207 (87)	0 (0)	4 (12)

[a]Credentials for three prescribers were not available.

APN = advanced practice nurse; Comp. = computer-generated; DO = doctor of osteopathy; DEA = Drug Enforcement Agency; EHR = electronic health record; MD = medical doctor; PA = physician assistant.

Table 4

Prescription deviations from best practice

"Best practice" guideline	**Deviations from best practice (n = 510) No. (%)**
1. Illegible prescription	0 (0)
2a. Illegible signature or printed patient name	0 (0)
2b. Illegible signature or printed provider name	0 (0)
3. No date listed on prescription	5 (1)
4. No weight or age recorded on if weight <40 kg	0 (0)
5. Wrong formulation of medication	2 (0)
6. Wrong dose of medication	0 (0)
7. Wrong frequency of medication	4 (1)
8. No information on dose/kg body weight if weight <40 kg	0 (0)
9. No pill quantity	2 (0)
10. Wrong instructions given	0 (0)
11. No callback telephone number	0 (0)
12. Use of error-prone abbreviations, symbols, or dose designations	33 (6)
Total	**46 (9)**